The cause of the fire remains unknown. Perhaps it was a carelessly thrown match or cigarette? Perhaps it was arson? What is known, though, is that the rapid spread of the fire, and the intense heat, were due mainly to the type of waterproofing used on the tent. Waterproofing the canvas was essential if, in order to maximize profits, shows were to be held in the rain. With World War II on, and the US military needing as many supplies as possible, the circus owners were not able to acquire the safe waterproofing they wanted. Paraffin, though, is a great waterproofing agent. However, being a solid, it needed to be dissolved in gasoline to produce a paste--a very flammable paste!--that could be painted onto the canvas.

Once the fire began, it was virtually impossible to extinguish. Foam extinguishers and modern equipment were not available at that time, and the hoses and buckets of water used were not only ineffective (because water and gasoline do not mix, with the later floating on water) but actually spread the fire even more quickly. The circus paid 10 years' profits to compensate the families of victims.

Source: Rimetz, B. (2005). The great Hartford circus fire. *ChemMatters*, *23*(1), 4-7.

World First MarsLink Mission Participants Learn and Enjoy Science

Dana Barry
Clarkson University, NY, USA and *Ansted University, Malaysia*
dmbarry@clarkson.edu

Abstract

Students learn and experience the excitement of science by actively participating in the MarsLink Space Mission, an educational component of the National Aeronautics and Space Administration's (NASA) Mars Missions. This Mission has been made possible by Space Explorers, Inc., in collaboration with NASA. In the World's First MarsLink Mission, which includes an international team of students in the United States and Malaysia, participants perform science activities and projects relating to Mars and have opportunities to interact with other teams, educators, and scientists around the world.

Introduction

The World's First MarsLink Mission, organized by the author, includes an international team with members in the United States and Malaysia. It is an ongoing program that involves all available Mars Missions and lots of science. This MarsLink Mission is an educational component to the National Aeronautics and Space Administration's (NASA) Mars Missions. It is sponsored by the Northern New York section of the American Chemical Society, and has support from Space Explorers, Inc. and NASA. MarsLink, available through Space Explorers, Inc. (2004) includes a science curriculum, mission simulation, opportunities to chat online with space scientists, and data analysis.

My program started, at Clarkson University in 2000, with a mission simulation and a linkup to the Mars Global Surveyor Spacecraft via the Internet. Members of the community, as well as news media, were invited to the event. The team enjoyed communicating, by conference phone, with a mission controller and receiving and analyzing live data from the spacecraft. They also learned about mission positions, duties, instruments aboard the spacecraft, and a teamwork approach to

solving problems. The positions and duties assigned to MarsLink team members during the mission simulation included the Public Affairs Officer (informing the mission team, spectators, and the general public about mission activities), the Spacecraft Engineer (responsible for spacecraft operations), and the Mission Design Officer (responsible for controlling and navigating the spacecraft).

During 2001, I traveled to Malaysia to visit the Malaysian team comprising Ansted University college students and junior high students from St. Xavier's Institute in Penang. I discussed the mission, described the instruments aboard the spacecraft, and gave instructions for accessing and analyzing incoming data from Mars. Dr Roger Haw, Co-Founder of Ansted University, is coordinating the team's efforts in Malaysia. The US component of the team includes upper elementary level students from St. Mary's School, Canton, New York and junior/senior high school students from Norwood Norfolk Central School, Norwood, New York. Team members exchange ideas, and share information, through email and at their Space Explorers, Inc. website. Photos and details of team activities may also be found at Barry (2005).

Team Activities and Progress

The exploration of Mars can be compared to a large science research project. It is an investigation of the planet's chemical makeup and reactions (Barry, 2001). This information is obtained from sophisticated instruments aboard the spacecrafts (Barry, 2002). The World First MarsLink team became acquainted with some of the equipment. They learned about the magnetometer and electron reflectometer, which measure the magnetic properties of Mars and the interaction of Mars' magnetic field with the local solar wind. Together, these instruments measure the strength of the magnetic field induced in the interior of Mars and the magnetic properties of Mars' crust at the surface. Mars does not have a strong magnetic field. In fact, it is almost non-existent. The students examined diagrams and photos from the thermal emission spectrometer, which measures the thermal infrared energy coming from the surface of Mars. A major purpose of this instrument is to identify minerals on the surface and use this information, along with morphology and other data, to understand the geologic history of Mars. They saw images of the surface of Mars taken by the Mars orbiting camera, which also serves as a weather satellite. This camera records the movement of clouds and the progress of dust storms. Participants also discussed the Mars orbiter laser altimeter (MOLA), an instrument designed to map the planet's topography. MOLA, which consists of an infrared laser and a collecting mirror, maps the heights of volcanoes and the depths of craters on Mars.

In addition, the Malaysian team members take part in many Mars-gazing activities. They use telescopes to view and study the planets and constellations. Also, the students attend and prepare science exhibits and participate in telescope-making workshops, planetarium shows, space-art painting contests, astrophotography, and rocket launching.

The US team members also carry out Mars-gazing activities and science lessons provided at the MarsLink website (Space Explorers, Inc., 2004). They prepared and studied the physical properties of carbon dioxide gas (the gas making up 95% of the planet's atmosphere) and made simulations of impact craters on Mars. This activity is now described.

Impact Crater Simulation Activity

Objective. Students use balls to make impact craters in flour, and determine the effect of drop height on the size (diameter) and depth of craters.

Materials. Plastic spoon, plastic cereal bowl, flour, ruler, ball (or marble), and graph paper.

Procedure. Provide each student, or pair of students, with a plastic cereal bowl filled with flour. Use the plastic spoon to smooth the flour surface before each test. Release the ball from various heights (e.g., 2.5, 5.0, 7.5, 10.0, 12.5, & 15.0 cm) above the bowl's surface and use the ruler to measure the crater depth, and diameter, for each test. Have students record and graph their data (drop height versus crater depth, and drop height versus crater diameter). Discuss the results in class. As an option, have students repeat this activity using a different-sized ball.

Figure 1. Sixth-grade students at St. Mary's School, Canton, New York measure crater depths in flour.

Conclusion

The international World First MarsLink team is making excellent progress. During 2004, this mission program received a national award of excellence, from the American Chemical Society, for it's creative teaching approach. In addition, the students are very happy and excited to have an opportunity to learn science by participating in Mars Missions. Their names are on a disk aboard the 2003 Mars Exploration Rover, which is presently exploring the planet's surface in search of geologic evidence of water in Mars' past. Highlights of this team's progress are displayed at Barry (2005).

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Demonstration

While the activities in this section of *SER* have been designated demonstrations, some might easily be structured as hands-on student learning experiences. Although some sample lesson sequences may be included, the notes provided both here and in the following section are meant to act primarily as stimuli for classroom activities and to provide teachers with background information, so please modify any sample pedagogy as you see fit.

Spread of Disease

Needed. One opaque drinking cup for each student, white vinegar, water, and bromothymol blue (BTB) indicator with eyedropper.